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SURVIVAL AND HEIGHT GROWTH OF TAMARACK PLANTED IN NORTHERN WISCONSIN

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ABSTRACT.--Tamarack trees from certain seed sources survived and grew well when planted on good upland sites in northern Wisconsin. Tamarack appears to have potential for short rotation pulpwood production in the Lake States.

OXFORD: 232.12(775)174.7 *Larix laricina*.
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Tamarack, *Larix laricina* (DuRoi) K. Koch, has potential for short rotation pulpwood production in the Lake States but little tamarack has been planted except for small tests. Consequently, little was known about genetic variation in the species until 1961 when the University of Minnesota began a cooperative rangewide study of geographic variation among more than 50 seed sources of tamarack (Pauley 1965). This paper presents survival and height growth data for trees from 24 of those seed sources planted at 2 locations in northern Wisconsin.

MATERIALS AND METHODS

We established two experimental plantings on abandoned farms in northern Wisconsin in October 1967 using 2-2 and 3-0 stock. The largest planting, including seedlings from 24 sources (table 1), is located in Forest County (latitude 46.0°N) on a well-drained upland site adjacent to natural tamarack. We considered this to be a good tamarack site (Roe 1957).

The second planting, consisting of trees from 17 of the same seed sources, is located in Oneida County (45.8°N). This planting is adjacent to a stand of mixed northern hardwoods and white pine.

A randomized, complete block design with 4-tree linear plots and 10 replications was utilized in both plantings. Trees were hand-planted at a spacing of 6 feet by 6 feet after all planting spots had been treated with herbicide.

RESULTS

Forest County Planting

Survival

Average survival was 94 percent for the 9-year-old trees and 78 percent for the 8-year-old trees (table 1). The better survival of the older trees may be due to the larger size of stock at time of planting. There were no significant differences[1] in survival among the 9-year-old trees from 6 sources, but there were significant differences among the 8-year-old trees from 18 sources--52 to 92 percent. Over 80 percent of the mortality occurred during the first 2 years after planting, much of it resulting from heavy snow breakage of the main stems. Trees planted from seed collected

[1] *All significant differences are at the 5 percent level.*

Table 1.--*Origin, survival, and total height of tamarack planted in northern Wisconsin from seed collected from 24 sources*

Age[1]	Source No. IFG	Source No. Minn.	Seed Source State or Province	Seed Source County	Lat. (°N)	Long. (°W)	Forest Co.[2] Survival	Forest Co.[2] Total height	Oneida Co.[3] Survival	Oneida Co.[3] Total height
							Percent	*Ft*	*Percent*	*Ft*
9	3036	48	ME	Somerset	45.7	71.2	90	10.5		
	3019	27	WI	Eau Claire	44.7	91	98	9.7	72	8.6
	3007	12	WI	Washburn	46	91.8	90	9.3		
	3014	21	MN	Anoka	45.1	93	100	9.1	80	8.1
	3011	17	WI	Waukesha	43	88.2	92	8.7	62	7.0
	3038	50	MI	Van Buren	42.2	86.1	92	8.6	70	7.4
						Average	94	9.3	71	7.8
8	3282		WI	LaCrosse	43.8	91.1	82	7.5	58	6.4
	3319	100	MN	Anoka	45.2	93.1	52	7.3	52	4.9
	3266		WI	Oneida	45.8	89.2	90	7.2		
	3330	127	ME	Somerset	45.6	70.3	88	7.1	80	6.4
	3265		WI	Forest	45.8	88.9	85	7.1	72	5.6
	3333	131	NS	Annapolis	44.8	65.0	75	6.8	92	6.5
	3272		MI	Alger	46.5	87.0	90	6.7		
	3283		MN	Itasca	47.5	94.1	92	6.6	78	5.4
	3284		MN	Itasca	47.4	93.6	85	6.6	70	6.0
	3323	111	WI	Trempaleau	44.2	91.5	78	6.6		
	3320	101	MN	St. Louis	47	93	85	6.5	75	4.9
	3324	117	MAN		50.1	95.4	92	6.3	75	5.2
	3332	129	ONT	Oxford	43.2	80.6	70	6.3	82	6.3
	3327	122	MI	Chippewa	46.3	84.2	60	6.2	78	6.5
	3331	128	MI	Houghton	47.0	88.4	78	6.2	78	4.5
	3273		MI	Alger	46.5	87.0	78	5.6	72	5.3
	3337	149	MI	Ingham	42.5	84.8	62	5.0		
	3322	110	ATA		56.6	111.2	70	4.2		
						Average	78	6.4	74	5.7

[1]All trees planted at same time: Age 9 - trees planted as 2-2 stock;
Age 8 - trees planted as 3-0 stock.

[2]Planting is located in Forest County (Lat. 46.0°N).

[3]Planting is located in Oneida County (Lat. 45.8°N).

in Anoka Co., Minnesota (3319) were particularly susceptible to this type of injury. Sajdak (1970) also reported heavy snow damage to trees from many of the same seed sources.

Height Growth

Average total height of the 8- and 9-year-old trees was 6.4 and 9.3 feet, respectively (table 1). Although there were no significant differences in total height of 9-year-old trees from six sources, total height of trees from a Maine seed source (3036) exceeded that of trees from a Lower Michigan source (3038) by nearly 2 feet. There were significant differences in total height of 8-year-old trees from 18 sources.

An early June frost in 1972 damaged nearly all trees in this planting. Damaged trees developed multiple terminal shoots and length of the longest shoot averaged only 0.5 feet in 1972 compared to 1.5 feet in 1971. There was considerable variation in shoot reduction among trees from different seed sources, suggesting seed source related variation in sensitivity to late spring frost.

Oneida County Planting

Survival

Survival at this site averaged 71 and 74 percent for 9- and 8-year-old trees, respectively (table 1). There was considerable variation in survival among sources (62 to 80 percent for 9-year-old trees from 4 sources and 52 to 92 percent for 8-year-old trees from 13 sources); however, these differences were not significant for trees of either age class, probably because of great site variation among plots of trees from the same seed sources.

Less snow damage occurred in this planting and only 58 percent of all mortality occurred during the first 2 years after planting.

Height Growth

Total height at this site averaged 5.7 feet for the 8-year-old trees and 7.8 feet for the 9-year-old trees (table 1). There were no significant differences in total height among the 9-year-old trees from four sources, but there were significant differences among the sources of younger trees. Trees from a Nova Scotia (3333) source and a Chippewa Co., Michigan, (3327) source were tallest (6.5 feet), while those from Houghton Co., Michigan, (3331) were shortest (4.5 feet).

This planting was apparently little affected by the late spring frost in 1972; in fact, trees of both ages grew faster in 1972 than in 1971. Terminal elongation of the fastest growing trees in both plantings in years when frost was not a problem ranged from 2.0 to 3.1 feet.

DISCUSSION

Tamarack is very sensitive to variations in site, quality of planting stock, and competition. Consequently, there was more variability among trees within and among plots of the same seedlot than usually encountered in a pine plantation. For example, the five tallest trees in any seedlot exceed the seedlot average by almost 40 percent. This minimized ability to discriminate statistically among the seedlots in this study. While correlation of survival of trees from sources planted at both locations was not significant ($r = 0.1728$), correlation of total height of trees from the same sources was significant ($r = 0.8222$). Therefore, a few generalizations regarding between-seed source differences in height growth are possible. Trees from seed sources nearest to the planting sites--Wisconsin and Minnesota--grew best. But trees from more distant seed sources may grow as well as trees from more local seed sources, at least during early years.

SEED SOURCE RECOMMENDATIONS

Based on the results of this test the following seed sources of tamarack can be recommended provisionally for planting on similar sites in northern Wisconsin:

1. Maine, Somerset Co. (3036, 3330)
2. Wisconsin, Eau Claire Co. (3019)
   La Crosse Co. (3282)
   Oneida Co. (3266)
3. Nova Scotia, Annapolis Co. (3333)

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